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ABSTRACT

This report describes long-term trends in perinatal mortality in the United States in three basic parts: development of perinatal mortality measures, components of fetal and infant mortality, and trends and differentials in perinatal mortality. Perinatal deaths refer to the sum of spontaneous fetal deaths occurring after 20 weeks gestation plus infant deaths occurring during the first 27 days following birth. Discussed in the first part of the report are the emergence of the concept of a perinatal period, the three definitions of the perinatal period, and the use of rate or ratio as measures of perinatal mortality. Discussed next are the distribution of fetal and infant deaths and trends in fetal and infant mortality. Finally, the report presents data on perinatal mortality ratios for the white population and for races other than white for each of the years 1950-1981. The differential in birth weight distribution, sex differentials, and geographic variations are also discussed. Also included are references, technical notes, four figures, and eight tables. (TRS)

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Perinatal Mortality in the United States: 1950–81

by Eve Powell-Griner, Ph.D., Division of Vital Statistics

Introduction

This report describes long-term trends in perinatal mortality in the United States. Perinatal deaths refer to the sum of spontaneous fetal deaths occurring after 20 weeks gestation plus infant deaths occurring during the first 27 days following birth. Perinatal statistics by race and sex for the United States and each State are reported annually in *Vital Statistics of the United States, Volume II, Mortality, Part A*, beginning with 1979. They are derived from data on three vital events reported to the National Center for Health Statistics (NCHS): Fetal deaths, infant deaths, and live births. Measures of perinatal mortality supplement other statistics on fetal and infant mortality published by NCHS.

Development of perinatal mortality measures

Components of fetal and infant mortality can be described in terms of the age at which death occurs. A fetal death refers to the death of a product of human conception prior to complete extraction or expulsion from its mother, irrespective of the duration of pregnancy.[1] In this report, fetal deaths refer only to deaths of fetuses of at least 20 weeks gestation. Fetal deaths can be characterized as "early" (20–27 weeks gestation) and "late" (28 weeks gestation or more). An infant death refers to the death of a liveborn infant under 1 year of age. Typically, infant deaths are described in terms of neonatal (less than 28 days of age) and postneonatal (28 days–11 months) deaths. Neonatal deaths can be further divided into "early" (less than 7 days) and "late" (7–27 days) components. Perinatal deaths refer to a combination of fetal deaths of at least 20 weeks gestation and neonatal deaths; the deaths that are included depend upon the perinatal definition being used.

The concept of a perinatal period emerged in the late 1940's in response to a growing awareness by physicians and other researchers of the relatively large number of deaths in the period immediately before and after delivery. This concept reflected the belief that circumstances responsible for the majority of neonatal deaths arose from conditions established before delivery or from the stresses during the birth process itself. Because many of these same circumstances were responsible for fetal deaths of 20 weeks or more gestation, a concept that combined fetal deaths of at least 20 weeks gestation with infant deaths of less than 28 days seemed particularly useful in studying reproductive loss.[2] Another factor contributing to the interest in developing a new mortality measure was the awareness that some infant deaths occurring shortly after birth were reported as fetal deaths and that fetal deaths were sometimes reported as infant deaths.

The term "perinatal mortality" was first proposed by Peller in 1948[3] to denote deaths of fetuses during pregnancy and labor and deaths of infants in the early days of life. In 1954 the World Health Organization supported the concept of perinatal mortality but did not specify the range of the perinatal period.[4] The 1956 Public Health Conference on Records and Statistics in the United States recommended that, for general use in analysis of vital-record data within this country, the perinatal mortality rate include fetal deaths of 20 weeks or more gestation and infant deaths of less than 7 days. However, the Conference acknowledged the usefulness of perinatal mortality rates based upon fetal deaths of 20 weeks gestation or more and infant deaths of less than 28 days, particularly for evaluation of maternal and child health programs.[5] In 1965, the World Health Organization recommended that the definition of the perinatal period include fetal deaths from the 28th completed week of pregnancy and neonatal deaths of less than 7 days. At that time, the World Health Organization also encouraged countries to extend the collection of data down to the 20th completed week of gestation and up to the 28th day of life.[6]

The recommendations of the World Health Organization

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and the Public Health Conference on Records and Statistics are the basis for the three perinatal mortality measures generally used in the United States. Perinatal Definition I, the most restrictive definition, refers only to fetal deaths of 28 weeks or more gestation and infant deaths of less than 7 days. The most inclusive measure, Perinatal Definition II, refers to fetal deaths of 20 weeks or more gestation and infant deaths under 28 days of age. Perinatal Definition III includes fetal deaths of 20 weeks gestation or more and infant deaths of less than 7 days.

Effective with data for 1979, NCHS began publishing statistics for all three perinatal measures; however, this report focuses upon Perinatal Definition I for the following reasons:

- Definition I limits the infant death group to those less than 7 days; during this early infant period, prenatal conditions and circumstances surrounding the delivery are more influential to nonsurvival than are postnatal factors.[2]
- Definition I limits fetal deaths to those of 28 weeks or more gestation; such deaths appear to be better reported than those occurring before 28 weeks gestation.[7]
- Almost three-fourths of all perinatal deaths by the broadest definition (II) occurred within the period encompassed by Definition I in 1981.
- Definition I is generally used for international comparisons.

Measures of perinatal mortality can be expressed as either a rate or a ratio. The perinatal rate is defined as the number of perinatal deaths per 1,000 live births and fetal deaths. The perinatal ratio is the number of perinatal deaths per 1,000 live births. Using Perinatal Definition I as an example, the perinatal rate would be computed as follows:

$$\frac{\text{Fetal deaths of 28 weeks gestation or more + infant deaths of less than 7 days in a specified year}}{\text{Fetal deaths of 28 weeks gestation or more + live births in the same year}} \times 1{,}000$$

The perinatal ratio would be calculated by:

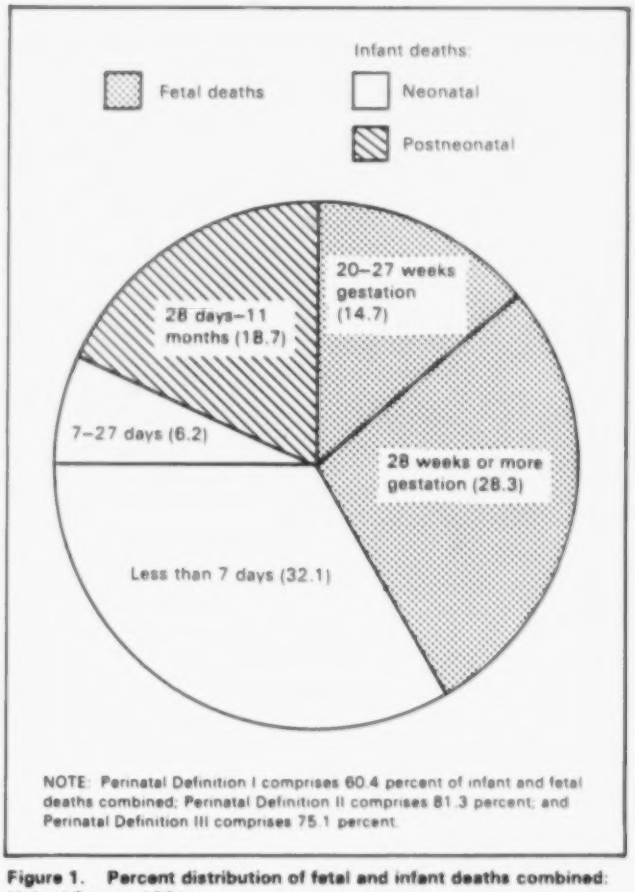
$$\frac{\text{Fetal deaths of 28 weeks gestation or more + infant deaths of less than 7 days in a specified year}}{\text{Live births in the same year}} \times 1{,}000$$

The perinatal rate includes fetal deaths in both the numerator and denominator; the perinatal ratio includes fetal deaths only in the numerator. The perinatal mortality rate—the preferred measure—is a closer estimate of risk of death in the perinatal period because for any data year the denominator more closely approximates the population at risk. However, actual numerical differences between perinatal mortality rates and ratios in the United States are small. For example, in 1981 the Perinatal Definition I rate and ratio were identical: 12.6. For most States, differences between perinatal rates and perinatal ratios are less than 1 percent. Although the text of this report emphasizes perinatal mortality rates, the detailed tables show both rates and ratios.

Components of fetal and infant mortality

The distribution of fetal and infant deaths combined by age for 1981 is shown in figure 1. The largest proportion of these events is accounted for by early neonatal deaths (32 percent), followed by late fetal deaths (28 percent). Postneonatal deaths accounted for 19 percent of all fetal deaths (20 weeks gestation or more) and infant deaths combined. Fetal deaths of 20–27 weeks gestation (15 percent) and late neonatal deaths (6 percent) contributed least to reported fetal and infant mortality. Perinatal deaths, according to Perinatal Definition I, included well over half (60 percent) of the infant deaths and fetal deaths of 20 weeks gestation or more.

Trends in fetal and infant mortality are shown in table A. The total number of fetal deaths of 20 weeks gestation or more and infant deaths decreased from 172,087 in 1950 to 75,901 in 1981. The percentage of fetal and infant deaths comprised by Perinatal Definition I deaths was 60 percent or more for all years shown in table A. Mortality rates also declined sharply during this period (figure 2). (For definitions of rates see Technical notes.) Infant mortality declined by 59 percent, from 29.2 to 11.9 infant deaths per 1,000 live births; and perinatal mortality closely paralleled this decline. Neonatal mortality declined more sharply than postneonatal mortality—61 percent



NOTE: Perinatal Definition I comprises 60.4 percent of infant and fetal deaths combined; Perinatal Definition II comprises 81.3 percent; and Perinatal Definition III comprises 75.1 percent.

Figure 1. Percent distribution of fetal and infant deaths combined: United States, 1981

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Table A. Number and percent distribution of components of fetal and infant deaths combined: United States, 1950, 1960, 1970, 1980, and 1981

Year	Fetal and infant deaths	Fetal deaths		Infant deaths			Perinatal Definition I[1]
				Neonatal deaths			
		Early (20–27 weeks gestation)	Late (28 weeks or more gestation)	Early (less than 7 days)	Late (7–27 days)	Postneonatal deaths (28 days–11 months)	
	Number						
1981	75,901	11,126	21,470	24,384	4,737	14,184	45,854
1980	78,879	10,754	22,599	25,492	5,126	14,908	48,091
1970	127,528	17,170	35,791	50,821	5,458	18,288	86,612
1960	179,353	16,496	51,984	71,125	8,608	31,140	123,109
1950	172,087	14,522	53,740	63,417	9,438	30,970	117,157
	Percent distribution						
1981	100.0	14.7	28.3	32.1	6.2	18.7	60.4
1980	100.0	13.6	28.7	32.3	6.5	18.9	61.0
1970	100.0	13.5	28.1	39.9	4.3	14.3	67.9
1960	100.0	9.2	29.0	39.7	4.8	17.4	68.6
1950	100.0	8.4	31.2	36.9	5.5	18.0	68.1

[1]Perinatal Definition I refers to infant deaths of less than 7 days (early neonatal) and fetal deaths with stated or presumed gestation of 28 weeks or more (late fetal).

compared with 55 percent. Although the rates of the components converged over the three-decade period, ranking of the rates remained the same: Death rates for fetuses of 28 weeks gestation or more and early neonatal deaths were higher than the mortality rates for any other component group.

Trends and differentials in perinatal mortality

Perinatal mortality ratios are presented in this report for the white population and for the population of races other than white ("all other") for each of the years 1950–81. In addition, perinatal rates are shown separately in figure 3 for the black population for 1979–81; data on late fetal deaths for the black population are not available before 1979. Rates for the population of races other than white are a close approximation of those of the black population, which is by far the largest component of this group. In 1981, the black population accounted for approximately 82 percent of births, 89 percent of fetal deaths, and 93 percent of neonatal deaths among races other than white.

Between 1950 and 1981 the perinatal mortality rate declined 61 percent, from 32.5 to 12.6 per 1,000 live births and fetal deaths. Reductions in perinatal mortality rates were generally continuous throughout the period; however, in the latter part of the period the rate of decline accelerated. The average annual decline was 1 percent in the 1950's, 2 percent in the 1960's, and 5 percent in the 1970's (table B). This pattern of accelerating decline was shared by the white population and the population of races other than white.

Perinatal mortality differentials between the white and the all other populations remained relatively constant over the 31-year period, reflecting similar percentage decreases for both groups (figure 3). In 1950, the perinatal mortality rate for all other races was 1.48 times that for the white population. In 1981, the ratio of rates was about the same, 1.55. A similar pattern occurred for infant mortality rates (figure 4).

The race differential in perinatal mortality rates is associated with the race differential in birth-weight distributions. In 1950, 7 percent of white live births weighed 2,500 grams or less compared with 10 percent of births to all other races.[8] By 1981, 6 percent of white live births weighed 2,500 grams or less compared with 11 percent for all other births.[9] The proportion of low-birth-weight infants for all other races has consistently remained higher than that of white infants. Approximately three-fourths of all neonatal deaths occur among low-birth-weight infants.[10,11]

Sex differentials

The sex differential in perinatal mortality for both the white and the all other populations declined between 1950 and 1981 (table C). For all races combined, approximately 130 males died for every 100 females that died during the perinatal period in 1950, compared with only 119 in 1981. The perinatal mortality sex ratio was 131:100 for the white population and 129:100 for all other races in 1950. In 1981, the perinatal mortality sex ratio was 119:100 for both populations.

Geographic variation

Perinatal mortality rates in 1981 were slightly higher in nonmetropolitan than in metropolitan counties (table D). The rate for nonmetropolitan counties was 12.7 deaths per 1,000

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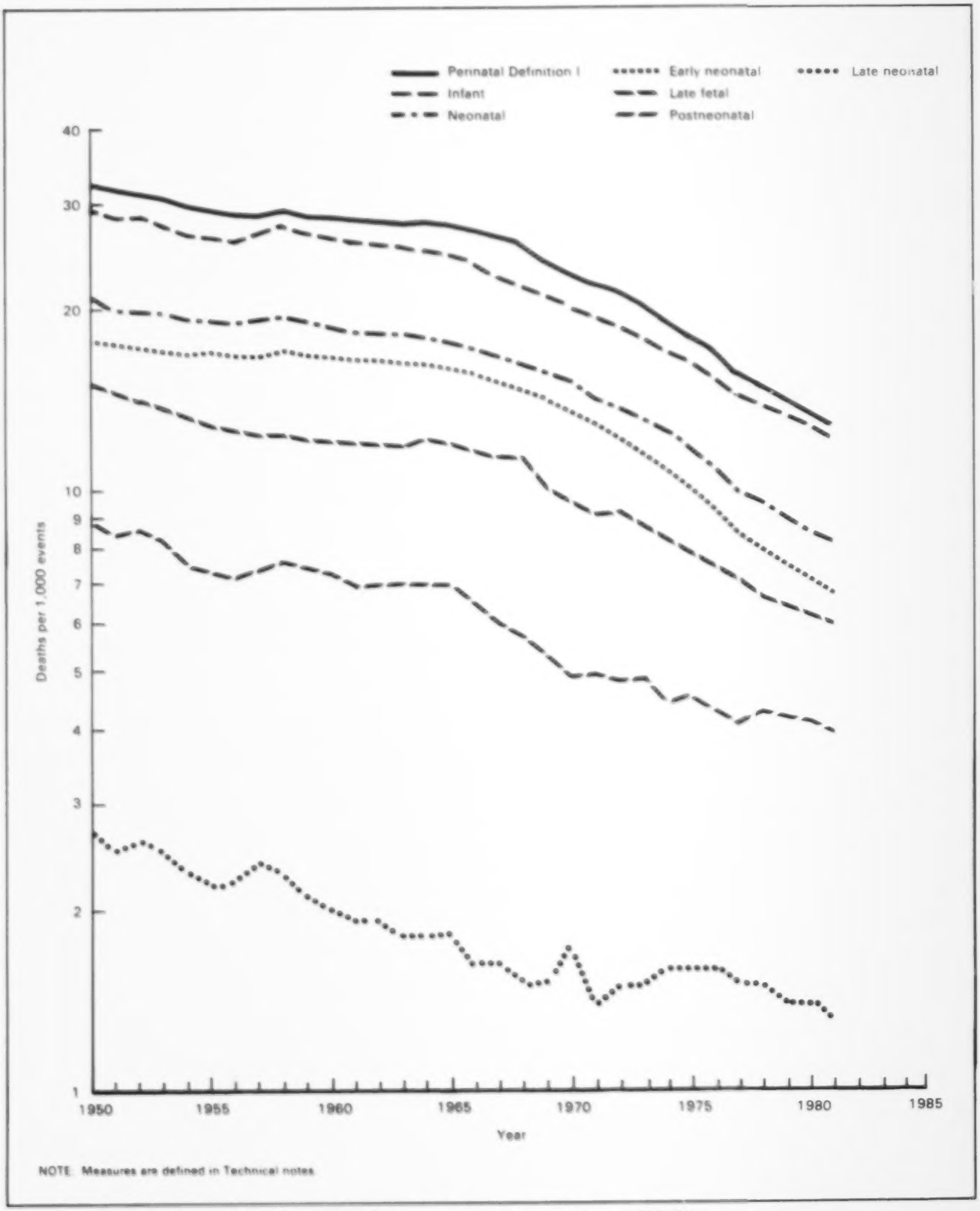

NOTE: Measures are defined in Technical notes.

Figure 2. Fetal, perinatal, neonatal, postneonatal, and infant mortality rates: United States, 1950–81

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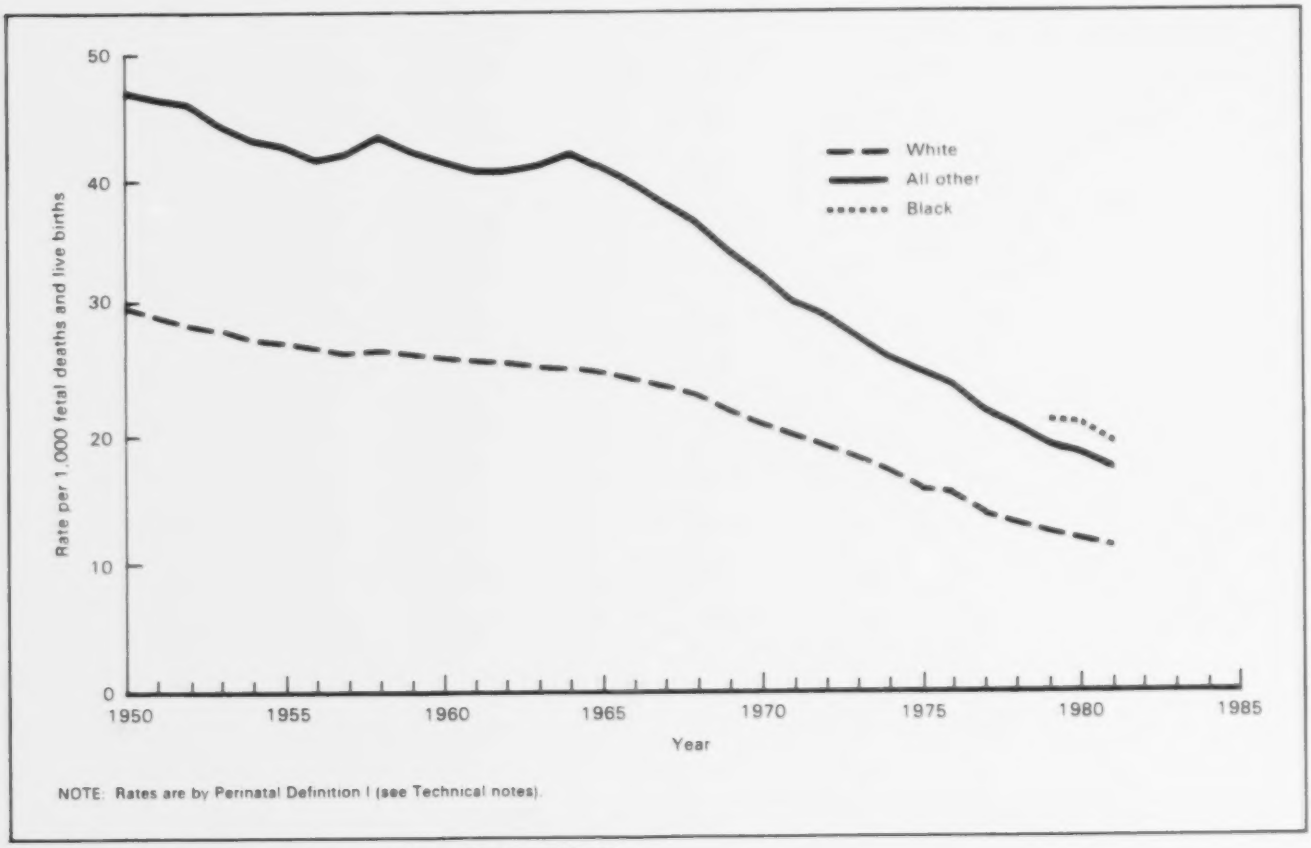

Figure 3. Perinatal mortality rates by race: United States, 1950–81

Table B. Perinatal mortality rates, percent change, and average annual percent change by race: United States, 1950, 1960, 1970, 1980, and 1981

[Rates are for Perinatal Definition I; see Technical notes. Rates are per 1,000 live births and fetal deaths]

Year	All races	White	All other
	Perinatal mortality rate		
1981	12.6	11.3	17.5
1980	13.2	11.9	18.7
1970	23.0	21.0	32.7
1960	28.6	26.2	41.6
1950	32.5	30.1	47.0
	Percent change		
1950–81	−61.2	−62.5	−62.8
1970–80	−42.6	−43.3	−42.8
1960–70	−19.6	−19.8	−21.4
1950–60	−12.0	−13.0	−11.5
	Average annual percent change		
1950–81	−3.0	−3.1	−3.1
1970–80	−5.4	−5.5	−5.4
1960–70	−2.2	−2.2	−2.4
1950–60	−1.3	−1.4	−1.2

live births and fetal deaths compared with 12.5 for metropolitan counties. The small differential is partly due to the race composition of the areas. When geographic comparisons are made by race, the differential is greater: For all other races, metropolitan rates were 6 percent lower than nonmetropolitan rates and for the white population, 4 percent lower. The largest mortality differences between metropolitan and nonmetropolitan counties were for the black population (8 percent).

Perinatal mortality rates also varied by geographic division and by State. In 1981, the East South Central Division had the highest rate, about 17 percent above the national figure. Higher rates prevailed there for both race groups compared with the national average for each group: 8 percent higher for the white population and 11 percent higher for the black population. The Mountain Division had the lowest rate for the white population (9 percent below the rate for the U.S. white population), and the Pacific Division had the lowest rate for the black population (22 percent below the national figure). Geographic variation in rate of perinatal death was greater for the black than the white population. Among the 50 States and the District of Columbia, rates for the black population ranged from 11.3 to 28.3 per 1,000 live births and fetal deaths—a difference that was almost

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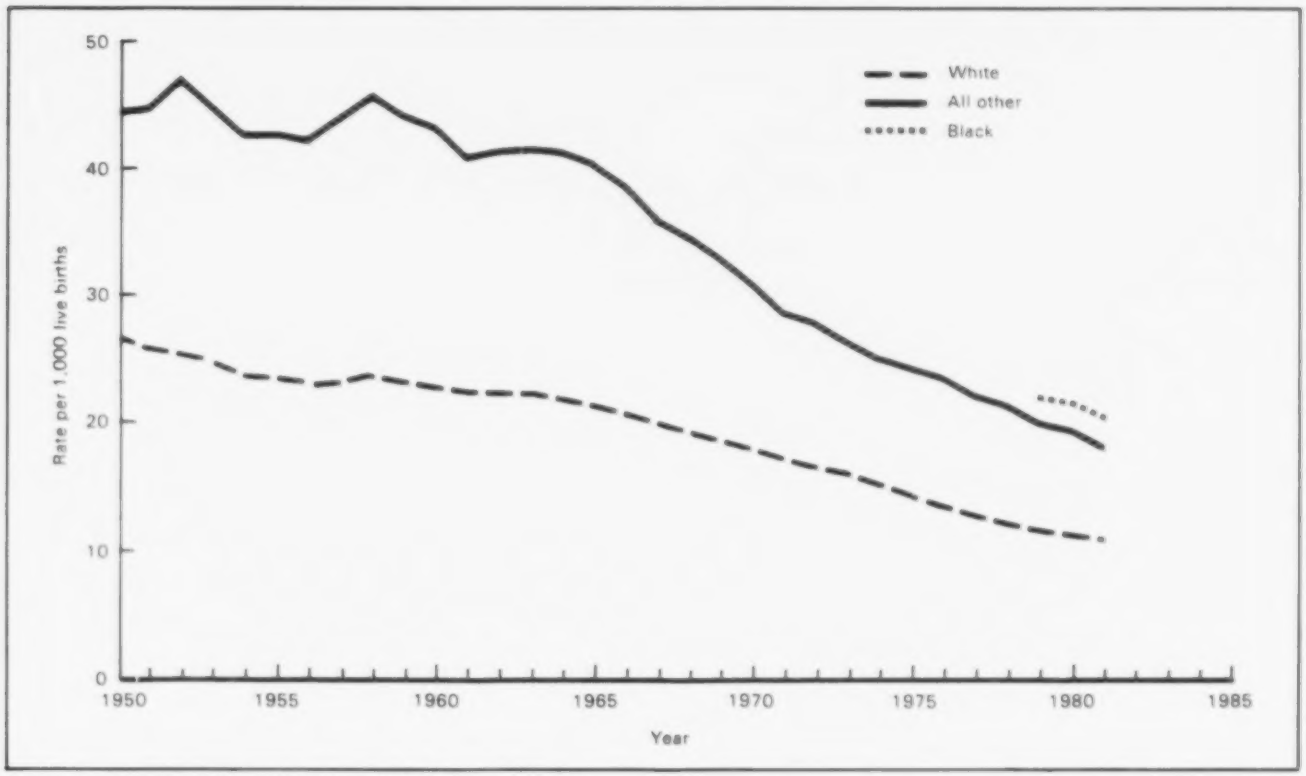

Figure 4. Infant mortality rates by race: United States, 1950–81

twice the range for the white population (8.1 to 18.1 per 1,000 live births and fetal deaths).

The analysis of geographic variation in perinatal mortality is restricted to Perinatal Definition I, which includes only fetal deaths of 28 weeks or more gestation. The usefulness of other perinatal indices for interstate comparisons appears to be limited by the variation in completeness of reporting fetal deaths between 20 and 28 weeks gestation. Data limitations that affect geographic comparability are discussed in the Technical notes section of this report.

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Table C. Perinatal mortality rates by race and sex, and sex ratios by race: United States, 1950 and 1981

[Rates are for Perinatal Definition I; see Technical notes. Rates are per 1,000 live births and specified fetal deaths. Ratios are the number of male perinatal deaths per 100 female perinatal deaths]

Year and race	Both sexes	Male	Female	Sex ratio
	Rate			
1981				
All races	12.6	13.3	11.8	119
White	11.3	12.0	10.7	119
All other	17.5	18.8	16.2	119
1950				
All races	32.5	35.8	28.9	130
White	30.1	33.2	26.9	131
All other	47.0	52.1	41.7	129

Table D. Perinatal mortality rates by race for metropolitan and nonmetropolitan counties and percent difference between metropolitan and nonmetropolitan counties: United States, 1981

[Rates are for Perinatal Definition I; see Technical notes. Rates are per 1,000 live births and specified fetal deaths]

Race	Total	Metropolitan counties	Nonmetropolitan counties	Percent difference
All races	12.6	12.5	12.7	−1.6
White	11.3	11.2	11.7	−4.3
All other	17.5	17.3	18.4	−6.0
Black	19.4	19.1	20.7	−7.7

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Table 1. Perinatal mortality ratios for 3 definitions, by race: United States, 1950–81

[Perinatal Definition I includes infant deaths of less than 7 days and fetal deaths with stated or presumed period of gestation of 28 weeks or more; Perinatal Definition II includes infant deaths of less than 28 days and fetal deaths with stated or presumed period of gestation of 20 weeks or more; Perinatal Definition III includes infant deaths of less than 7 days and fetal deaths with stated or presumed period of gestation of 20 weeks or more. Presumed gestational age not stated was changed beginning in 1969, see Technical notes. Ratios per 1,000 live births]

Year	Perinatal Definition I[1]			Perinatal Definition II			Perinatal Definition III		
	All races	White	All other	All races	White	All other	All races	White	All other
1981[2]	12.6	11.4	17.6	17.0	15.1	24.6	15.7	13.9	22.8
1980[2]	13.3	11.9	18.9	17.7	15.7	26.0	16.3	14.4	24.0
1979[2]	13.9	12.6	19.5	18.3	16.2	26.7	16.9	15.0	24.8
1978[2]	14.7	13.1	21.1	19.2	16.9	28.7	17.7	15.5	26.7
1977[2]	15.5	14.0	21.9	19.8	17.5	29.5	18.3	16.2	27.1
1976[2]	16.9	15.2	24.1	21.4	19.0	31.5	19.8	17.6	29.1
1975[2]	17.9	*16.2	25.3	22.3	19.9	32.8	20.7	18.5	30.4
1974[2]	19.1	17.4	26.3	23.7	21.4	34.2	22.2	20.0	31.8
1973[2]	20.2	18.5	27.9	25.2	22.6	36.4	23.6	21.2	34.2
1972[2]	21.4	19.5	30.0	26.3	23.5	38.7	24.8	22.2	36.4
1971[2]	21.9	20.0	30.6	27.6	24.8	40.8	26.3	23.6	38.7
1970[2]	23.2	21.1	33.2	29.3	26.2	44.0	27.8	24.9	41.7
1969	24.2	22.0	34.8	29.7	26.6	45.1	28.2	25.3	42.5
1968	26.1	23.8	37.7	31.9	28.5	48.6	30.4	27.3	46.0
1967	26.5	23.9	38.9	32.1	28.5	49.6	30.6	27.2	46.9
1966	27.2	24.6	39.9	32.9	29.2	50.9	31.2	27.8	47.8
1965	28.0	25.2	41.3	33.8	30.0	52.6	31.2	28.5	49.3
1964	28.4	25.5	43.2	34.3	30.3	54.7	32.5	28.8	51.2
1963[3]	28.2	25.6	41.8	34.0	30.4	52.8	32.2	28.8	49.4
1962[3]	28.5	26.0	41.7	34.3	30.8	52.7	32.4	29.3	49.2
1961	28.6	26.2	41.7	34.5	31.0	53.2	32.6	29.4	49.4
1960	28.9	26.5	42.4	34.8	31.4	53.6	32.8	29.7	49.6
1959	29.1	26.6	43.3	35.2	31.6	55.0	33.1	29.9	50.7
1958	29.6	27.0	44.5	36.0	32.3	56.5	33.6	30.4	51.9
1957	29.2	26.8	43.0	35.4	32.1	54.6	33.1	30.1	50.0
1956	29.3	26.9	42.8	35.4	32.1	54.2	33.1	30.2	49.8
1955	30.0	27.7	43.9	36.2	32.9	55.6	34.0	31.1	51.4
1954	30.2	27.8	44.3	36.5	33.3	55.9	34.2	31.3	51.5
1953	31.0	28.6	45.4	37.3	34.2	57.0	34.9	32.1	52.3
1952	31.6	29.0	47.5	38.1	34.6	60.3	35.6	32.5	55.2
1951	32.2	29.8	47.5	38.9	35.6	59.4	36.3	33.3	54.8
1950	33.0	30.5	48.1	39.7	36.4	60.0	37.0	34.1	55.3

[1]Figures for gestational age not stated are distributed for fetal deaths; see Technical notes.
[2]Excludes infant and fetal deaths and live births occurring to nonresidents of the United States.
[3]Figures by race exclude data for residents of New Jersey; see *Vital Statistics of the United States*, 1962 and 1963, Vol. II, Mortality, Part A, Technical Appendix.

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Table 2. Perinatal deaths and mortality ratios and rates for 3 definitions, by race and sex: United States, 1981

[Perinatal Definition I includes infant deaths of less than 7 days and fetal deaths with stated or presumed period of gestation of 28 weeks or more. Perinatal Definition II includes infant deaths of less than 28 days and fetal deaths with stated or presumed period of gestation of 20 weeks or more. Perinatal Definition III includes infant deaths of less than 7 days and fetal deaths with stated or presumed period of gestation of 20 weeks or more; see Technical notes. Ratios per 1,000 live births. Rates per 1,000 live births and specified fetal deaths]

Race and sex[1]	Perinatal Definition I[2]			Perinatal Definition II			Perinatal Definition III		
	Deaths	Ratio	Rate	Deaths	Ratio	Rate	Deaths	Ratio	Rate
All races	45,854	12.6	12.6	61,717	17.0	16.9	56,980	15.7	15.6
Male	24,921	13.4	13.3	33,702	18.1	17.9	31,066	16.7	16.5
Female	20,933	11.8	11.8	28,015	15.8	15.7	25,914	14.6	14.5
White	33,151	11.4	11.3	43,956	15.1	15.0	40,570	13.9	13.8
Male	18,006	12.0	12.0	23,992	16.1	15.9	22,077	14.8	14.7
Female	15,145	10.7	10.7	19,964	14.1	14.0	18,493	13.1	13.0
All other	12,703	17.6	17.5	17,761	24.6	24.3	16,410	22.8	22.5
Male	6,915	18.9	18.8	9,710	26.5	26.2	8,989	24.6	24.2
Female	5,788	16.3	16.2	8,051	22.7	22.4	7,421	20.9	20.7
Black	11,524	19.6	19.4	16,125	27.4	27.1	14,899	25.3	25.0
Male	6,296	21.1	21.0	8,852	29.7	29.3	8,199	27.5	27.1
Female	5,228	18.0	17.9	7,273	25.1	24.8	6,700	23.1	22.8

[1] Figures for sex not stated are distributed for fetal deaths; see Technical notes.
[2] Figures for gestational age not stated are distributed for fetal deaths; see Technical notes.

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Table 3. Perinatal deaths and mortality ratios and rates for 3 definitions, by race, for metropolitan and nonmetropolitan counties: United States, 1981

[Perinatal Definition I includes infant deaths of less than 7 days and fetal deaths with stated or presumed period of gestation of 28 weeks or more. Perinatal Definition II includes infant deaths of less than 28 days and fetal deaths with stated or presumed period of gestation of 20 weeks or more. Perinatal Definition III includes infant deaths of less than 7 days and fetal deaths with stated or presumed period of gestation of 20 weeks or more; see Technical notes. Ratios per 1,000 live births. Rates per 1,000 live births and specified fetal deaths]

Geographic area and race	Perinatal Definition I[1]			Perinatal Definition II			Perinatal Definition III		
	Deaths	Ratio	Rate	Deaths	Ratio	Rate	Deaths	Ratio	Rate
United States	45,846	12.6	12.6	61,717	17.0	16.9	56,980	15.7	15.6
White	33,147	11.4	11.3	43,956	15.1	15.0	40,570	13.9	13.8
All other	12,699	17.6	17.5	17,761	24.6	24.3	16,410	22.8	22.5
Black	11,521	19.6	19.4	16,125	27.4	27.1	14,899	25.3	25.0
Metropolitan counties	34,192	12.6	12.5	46,152	17.0	16.8	42,562	15.7	15.5
White	24,072	11.3	11.2	32,057	15.0	14.9	29,566	13.8	13.7
All other	10,120	17.4	17.3	14,095	24.2	24.0	13,016	22.4	22.1
Black	9,247	19.3	19.1	12,898	26.9	26.6	11,903	24.8	24.5
Nonmetropolitan counties	11,654	12.8	12.7	15,565	17.1	17.0	14,398	15.8	15.7
White	9,095	11.8	11.7	11,899	15.5	15.3	11,004	14.3	14.2
All other	2,579	18.5	18.4	3,666	26.3	25.9	3,394	24.4	24.0
Black	2,274	21.0	20.7	3,227	29.7	29.2	2,996	27.6	27.1

[1]Figures for gestational age not stated are distributed for fetal deaths; see Technical notes.

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Table 4. Perinatal Definition I mortality rates and ratios by race: United States, each division and State, 1981

[Perinatal Definition I includes infant deaths of less than 7 days and fetal deaths with stated or presumed gestation of 28 weeks or more. Rates per 1,000 live births and specified fetal deaths; ratios per 1,000 live births]

Division and State	Rate				Ratio			
			All other				All other	
	All races	White	Total	Black	All races	White	Total	Black
United States	12.6	11.3	17.5	19.4	12.6	11.4	17.6	19.6
New England	11.2	10.7	16.9	19.4	11.3	10.7	17.0	19.5
Maine	9.5	9.7	-	-	9.6	9.8	-	-
New Hampshire	9.5	9.4	*13.4	*26.3	9.5	9.5	*13.5	*26.8
Vermont	8.1	8.1	*16.4	-	8.2	8.1	*16.7	-
Massachusetts	10.7	10.3	15.3	17.7	10.8	10.3	15.4	17.8
Rhode Island	12.9	12.7	*14.2	*13.8	12.9	12.8	*14.3	*15.9
Connecticut	13.6	12.4	20.7	22.3	13.6	12.4	20.8	22.4
Middle Atlantic	12.7	11.5	17.2	18.5	12.8	11.6	17.3	18.7
New York	13.2	11.8	17.7	19.2	13.3	11.9	17.8	19.3
New Jersey	11.4	10.2	15.4	16.5	11.5	10.3	15.5	16.6
Pennsylvania	12.8	12.0	18.1	19.3	12.9	12.0	18.2	19.4
East North Central	13.3	11.9	19.7	20.8	13.3	12.0	19.9	20.9
Ohio	13.1	12.1	19.1	19.9	13.2	10.7	19.2	20.0
Indiana	12.9	12.2	18.2	19.2	13.0	12.3	18.4	19.4
Illinois	14.7	12.8	21.0	21.9	14.8	12.9	21.2	22.1
Michigan	12.9	11.3	20.4	21.7	13.0	11.3	20.6	21.9
Wisconsin	11.1	10.8	14.2	15.3	11.1	10.6	14.3	15.4
West North Central	11.5	11.0	16.2	18.5	11.6	11.1	16.4	18.6
Minnesota	10.7	10.2	16.9	23.3	10.7	10.3	17.0	23.4
Iowa	10.5	10.4	12.3	*14.2	10.5	10.5	12.4	*14.3
Missouri	13.1	12.4	16.7	17.7	13.2	12.5	16.8	17.9
North Dakota	10.5	10.3	*12.6	*8.8	10.6	10.4	*12.7	*8.8
South Dakota	11.2	10.3	16.3	*30.3	11.2	10.4	16.4	*30.9
Nebraska	10.6	10.3	14.8	17.4	10.7	10.4	14.9	17.5
Kansas	12.2	11.5	17.8	20.1	12.2	11.6	17.9	20.3
South Atlantic	14.5	11.9	20.3	20.9	14.6	12.0	20.5	21.1
Delaware	16.9	13.5	26.9	28.1	17.0	13.5	27.2	28.4
Maryland	13.6	11.4	18.1	18.9	13.7	11.5	18.2	19.0
District of Columbia	26.5	18.1	28.2	28.3	26.7	18.2	28.5	28.5
Virginia	14.1	12.0	19.8	20.8	14.2	12.1	19.9	21.0
West Virginia	14.6	14.3	20.7	23.3	14.7	14.4	20.9	23.5
North Carolina	14.4	12.1	19.3	20.0	14.5	12.2	19.4	20.2
South Carolina	16.6	12.2	22.8	23.0	16.7	12.3	23.0	23.3
Georgia	14.5	11.5	19.7	20.0	14.6	11.5	19.8	20.2
Florida	14.3	11.8	20.8	21.5	14.4	11.9	21.0	21.7
East South Central	14.8	12.2	21.2	21.5	14.9	12.3	21.4	21.7
Kentucky	13.6	13.1	18.3	19.2	13.7	13.2	18.5	19.4
Tennessee	14.2	11.9	21.7	22.1	14.3	12.0	21.9	22.3
Alabama	14.7	11.6	20.3	20.5	14.8	11.7	20.5	20.7
Mississippi	17.2	12.2	22.6	22.6	17.4	12.2	22.8	22.8
West South Central	12.3	11.3	16.3	17.4	12.4	11.3	16.4	17.5
Arkansas	12.1	9.8	18.8	19.3	12.2	9.9	19.0	19.5
Louisiana	13.9	11.2	18.2	18.8	14.0	11.2	18.4	18.9
Oklahoma	12.5	12.2	14.0	16.1	12.6	12.3	14.1	16.2
Texas	11.9	11.3	14.8	15.9	11.9	11.4	14.9	16.0
Mountain[1]	10.5	10.3	11.7	18.7	10.5	10.4	11.8	18.9
Montana	9.6	9.7	*9.1	*28.9	9.6	9.7	*9.2	*30.3
Idaho	9.5	9.8	*1.6	*10.9	9.6	9.8	*1.6	*11.0
Wyoming	12.9	13.2	*5.6	-	12.9	13.3	*5.6	-
Colorado	10.9	10.7	13.0	16.0	10.9	10.7	13.1	16.1
New Mexico[1]	8.9	9.3	7.2	*15.7	9.0	9.3	7.2	*15.9
Arizona	11.3	10.8	13.8	23.5	11.4	10.9	13.9	23.8
Utah	9.7	9.5	13.0	*21.0	9.7	9.6	13.1	*21.1
Nevada	11.3	10.9	13.0	17.7	11.3	11.0	13.1	17.8
Pacific	10.8	10.6	11.6	15.2	10.9	10.7	11.7	15.3
Washington	10.4	10.4	10.6	11.3	10.4	10.4	10.6	11.3
Oregon	10.1	10.1	10.4	*19.3	10.2	10.2	10.5	*19.5
California	11.1	10.8	12.2	15.3	11.1	10.9	12.2	15.4
Alaska	10.3	9.0	13.3	*21.7	10.3	9.0	13.4	*21.9
Hawaii	10.2	11.1	9.9	*9.3	10.2	11.1	10.0	*9.4

[1]The rates and ratios according to Perinatal Definition I may be slightly affected by a coding problem with fetal deaths occurring in New Mexico; see Technical notes.

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Technical notes

Sources of data

Counts of fetal deaths are based on data from reports of fetal deaths; counts of infant deaths are based on information from certificates of death; and counts of live births are based on information from certificates of live birth. For detailed information on the processing, classification, and tabulation of these events, see the technical appendixes of the respective volumes of *Vital Statistics of the United States.*[12]

Classification of data

Period of gestation—The period of gestation is the number of completed weeks elapsed between the first day of the last normal menstrual period (LMP) and the date of delivery. The first day of the last normal menstrual period is used as the initial date as it can be more accurately determined than the date of conception, which usually occurs 2 weeks after LMP. Data on period of gestation are computed from information on "date of delivery" and "date last normal menses began." If "date last normal menses began" is not on the record or the calculated gestation falls beyond a duration considered biologically plausible, "gestation in weeks" or "physician's estimate of gestation" is used.

Gestation not stated—A fetal death with gestation not stated is presumed to be of 20 weeks gestation or more if (1) the death occurred in a State that requires reporting of all fetal deaths of gestational age 20 weeks or more, or (2) the fetus weighed 500 grams or more in a State that requires reporting of all fetal deaths regardless of gestational age. For Perinatal Definition I, fetal deaths with gestation not stated but presumed to be 20 weeks or more are allocated to 28 weeks or more according to the proportion of fetal deaths with stated gestational age that fall into that category. For Perinatal Definitions II and III, fetal deaths with presumed gestation of 20 weeks or more are included with those of stated gestation of 20 weeks or more. For all three definitions, fetal deaths with not-stated sex are allocated within gestational age groups on the basis of the distribution of stated cases.

Race—The race of the fetus or infant is based on the race of the parents. If the parents are of different races, the following rules apply. (1) When only one parent is white, the fetus or infant is assigned to the other parent's race. (2) When neither parent is white, the fetus or infant is assigned to the father's race with one exception: If the mother is Hawaiian or part-Hawaiian, the fetus or infant is classified as Hawaiian.

When the race of one parent is missing or ill-defined, the race of the other determines that of the fetus or infant. When the race of both parents is missing, the race of the fetus or infant is allocated to the specific race of the fetus or infant on the preceding record.

Quality of data

All States have adopted laws that require the registration of births and deaths and reporting of fetal deaths. It is believed that over 99 percent of the births and deaths occurring in this country are registered.

State requirements for reporting of fetal deaths vary. Most States require reporting of fetal deaths of gestations of 20 weeks or more. There is substantial evidence that not all fetal deaths for which reporting is required are reported.

For States having a minimum gestation period requirement, underreporting of fetal deaths may occur near the lower limit. In areas requiring the reporting of fetal deaths of 20 weeks or more, the total number reported for 20–23 weeks is lower than the number reported for 24–27 and 28–31 weeks gestation. In contrast, in areas requiring reporting of all fetal deaths, regardless of the period of gestation, the number reported for 20–23 weeks is larger than the number for 24–27 and 28–31 weeks.

To maximize comparability of data by year and by State, fetal death and perinatal mortality statistics are based on fetal deaths of 20 weeks or more gestation. Beginning with 1969, fetal deaths of not stated gestation were excluded for States requiring reporting of all products of conception except for those with a stated birth weight of 500 grams or more. In 1981 this rule applied to Colorado, Georgia, Hawaii, New York, Rhode Island, and Virginia.

Variations in fetal-death reporting requirements and practices have implications for comparing perinatal rates among States. Because reporting is generally poorer near the lower limit of the reporting requirement, States that require reporting of all products of conception regardless of gestation are likely to have more complete reporting of fetal deaths of 20–27 weeks than are other States. The larger number of fetal deaths reported by these "all periods" States may result in higher perinatal rates compared with States for which reporting is less complete. Accordingly, reporting completeness may account, in part, for differences among the State perinatal rates, particularly differences for Perinatal Definitions II and III which use data for fetal deaths of 20–27 weeks.

Comparability problems also arise from the inconsistent application of the definition of fetal death by individual reporting units. For example, some live-born infants who die shortly after birth, particularly those born prematurely who die before the umbilical cord is severed or while the placenta is still attached, may erroneously be reported as fetal deaths. This type of error may be more of a problem in States lacking a precise definition of fetal death. Errors in application of the definition of live birth and fetal death can have the effect of increasing perinatal ratios by decreasing the number of live births in the denominator. Perinatal rates, however, are not as affected by this type of error.

Another problem that may affect comparability of perinatal rates among States involves fetal deaths with unknown gestation. Fifteen percent of all U.S. fetal death records are of

NOTE: A list of references follows the text.

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unknown gestational age. There is considerable variation among the States in the proportion of fetal deaths of unknown gestation. These fetal deaths are allocated in the perinatal statistics to 20–27 weeks and 28 weeks or more, according to the proportion of fetal deaths with known gestation that fall into the two categories. For example, a State that requires reporting of all products of conception, and that also has a relatively high proportion of fetal deaths with unknown gestation, may have a larger proportionate share of fetal deaths allocated to 20–27 weeks than a State that has a similar proportion of fetal deaths with unknown gestation but which requires reporting only for 20 weeks gestation or more.

Gestational age of the 183 fetal deaths occurring in New Mexico was not coded in 1981 and therefore was assigned to gestational age not stated. Most of these were to residents of New Mexico. Since the fetal deaths with not stated gestation are allocated as described above, the effect of the coding problem on the number of perinatal deaths, rates, and ratios for the United States, the Mountain Division, and New Mexico is assumed to be small. A more detailed discussion is published in the *Vital Statistics of the United States* for 1981.[13]

Computation of rates

The rates shown in figure 2 of this report were computed using the following formulas.

$$\text{Infant mortality rate per 1,000 live births} = \frac{\text{Number of deaths less than 1 year of age during a period}}{\text{Number of live births during the same period}} \times 1{,}000$$

$$\text{Neonatal mortality rate per 1,000 live births} = \frac{\text{Number of deaths less than 28 days of age during a period}}{\text{Number of live births during the same period}} \times 1{,}000$$

$$\text{Early neonatal mortality rate per 1,000 live births} = \frac{\text{Number of deaths less than 7 days of age during a period}}{\text{Number of live births during the same period}} \times 1{,}000$$

$$\text{Late neonatal mortality rate per 1,000 live births} = \frac{\text{Number of deaths 7–27 days of age during a period}}{\text{Number of live births during the same period}} \times 1{,}000$$

$$\text{Postneonatal mortality rate per 1,000} = \frac{\text{Number of deaths 28 days–11 months of age during a period}}{\text{Number of live births during the same period}} \times 1{,}000$$

$$\text{Perinatal Definition I mortality rate per 1,000 live births and fetal deaths} = \frac{\text{Number of infant deaths of less than 7 days + number of fetal deaths with stated or presumed period of gestation of 28 weeks or more during a period}}{\text{Number of live births + number of fetal deaths with stated or presumed period of gestation of 28 weeks or more during the same period}} \times 1{,}000$$

$$\text{Late fetal death rate per 1,000 live births and fetal deaths} = \frac{\text{Number of fetal deaths of 28 weeks or more stated or presumed gestation during a period}}{\text{Number of fetal deaths of 28 weeks or more stated or presumed gestation + number of live births during the same period}} \times 1{,}000$$

NOTE: A list of references follows the text.

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Symbols

- - -	Data not available
. . .	Category not applicable
-	Quantity zero
0.0	Quantity more than 0 but less than 0.05
Z	Quantity more than zero but less than 500 where numbers are rounded to thousands
*	Figure does not meet standards of reliability or precision (base of measure less than 20 events)

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